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G3R
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Selected US specifications from IPC sub-classes B29F
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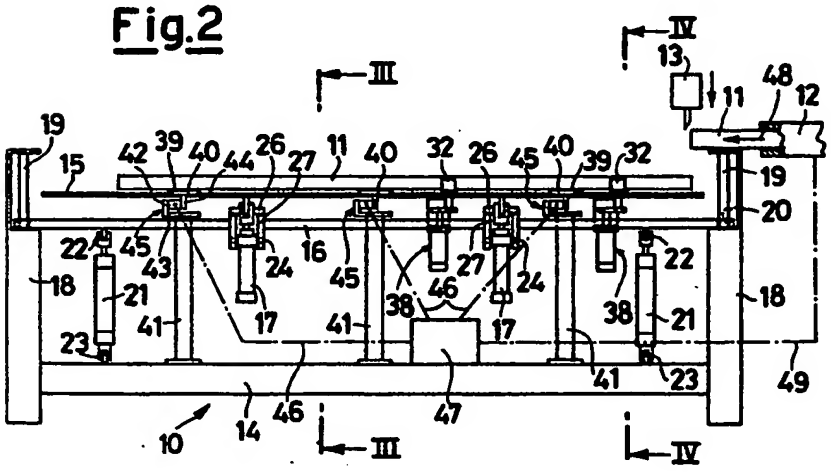
(54) Apparatus for automatically weighing extruded thermoplastics sections, and adjusting the extrusion apparatus

(57) The extruded section (11) which is continuously delivered by a pulling unit from the extruder (12), onto a table (15), is cut into lengths by a shear (13) and each length is sequentially lowered with the table (15), to be deposted on weighing trays (40) which pass through table openings (39). An electronic control (47) automatically adjusts the production speed of the section, e.g. of the pulling unit, extruder (12), or metering unit, to maintain the section weight within predetermined limits. Sections within or outside the limits are respectively unloaded onto opposite sides of the table, either by tilting the table about alternative pivots (26) on opposite sides of the table (15), or by employing means (65, Figs. 5 & 6) which displaces the sections (11) laterally from the table and weighing means (10), onto trays (59) which are then further conveyed by overhead pincers to a car (75).

Fig.2



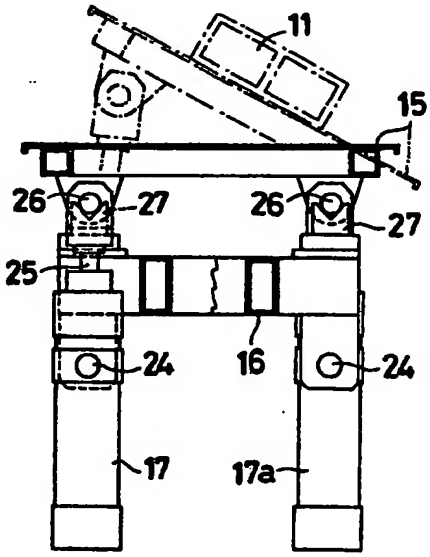


Fig.3

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Fig.1

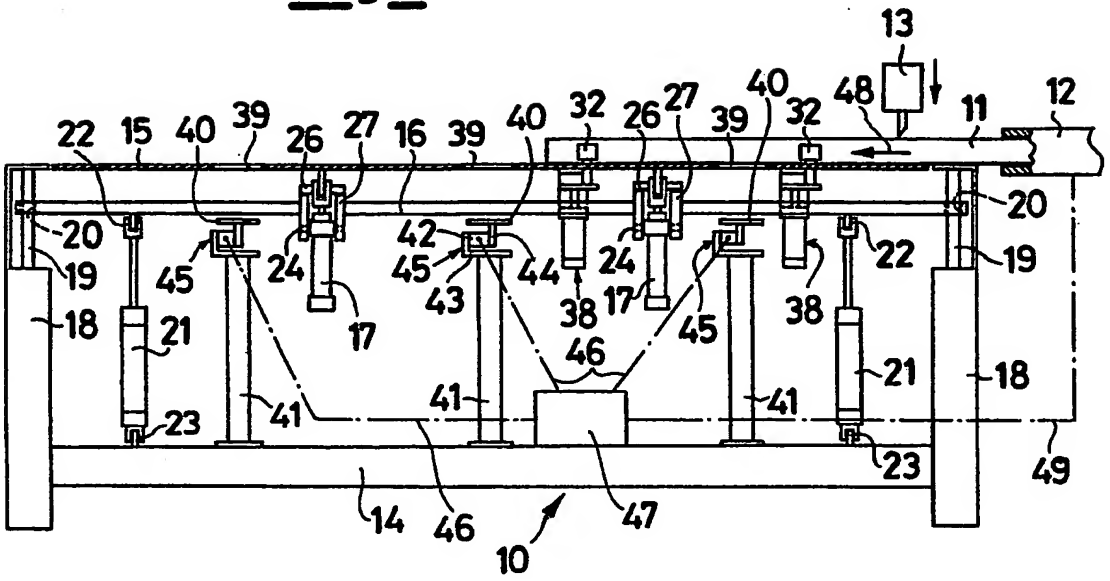
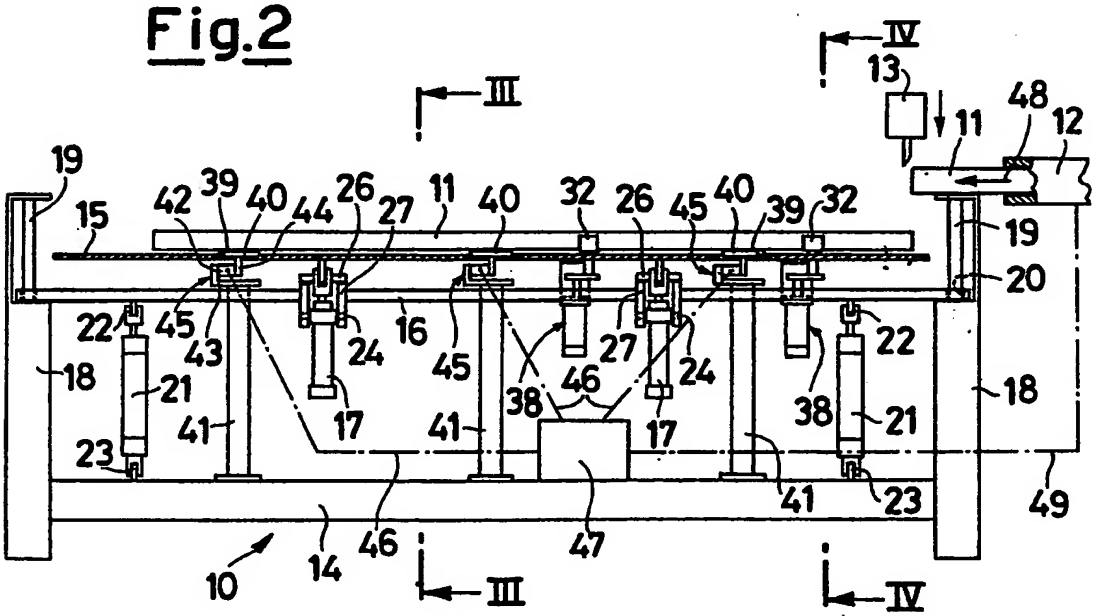


Fig.2



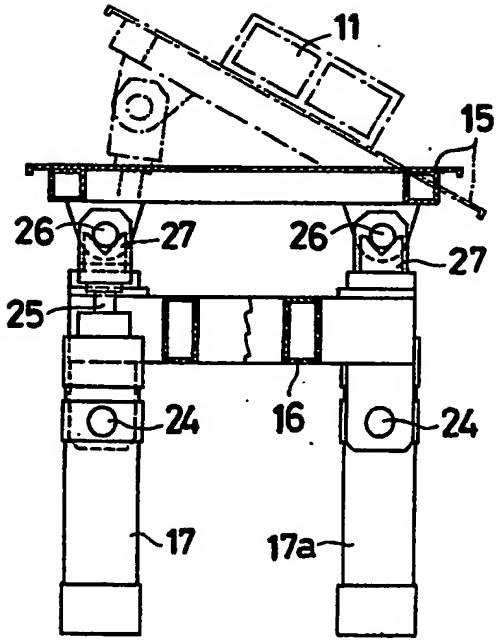


Fig.3

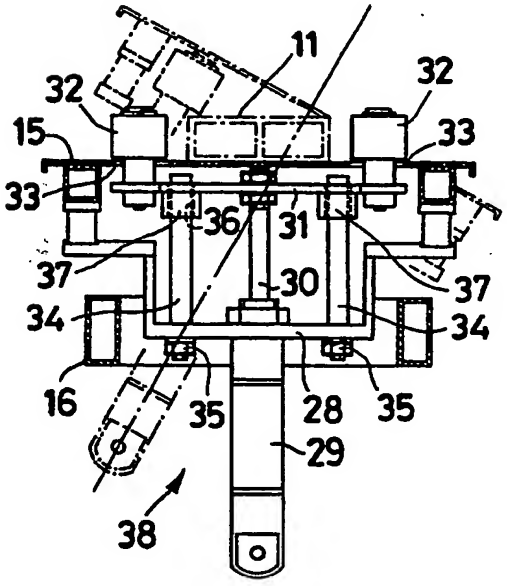


Fig.4

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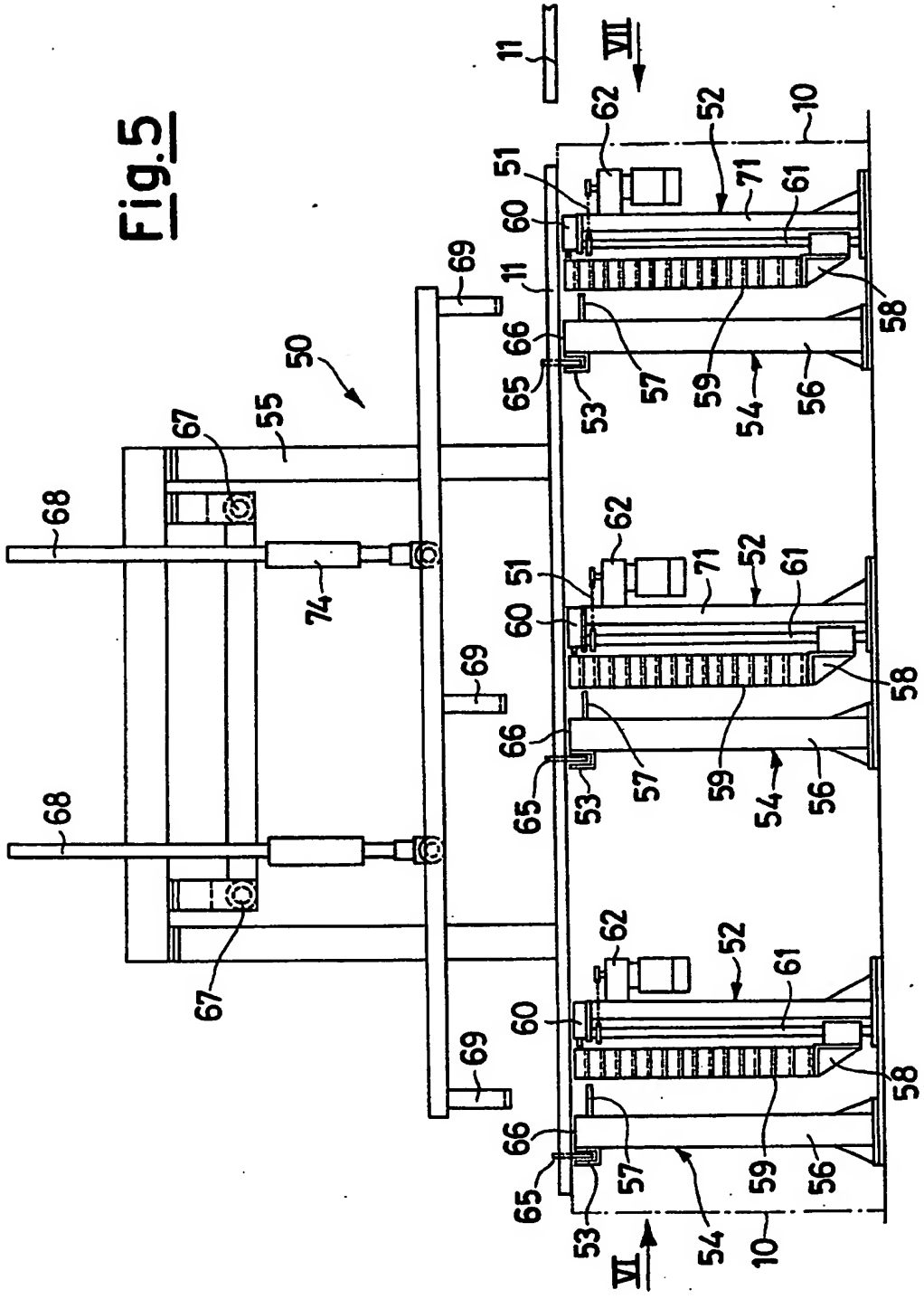
Fig.5



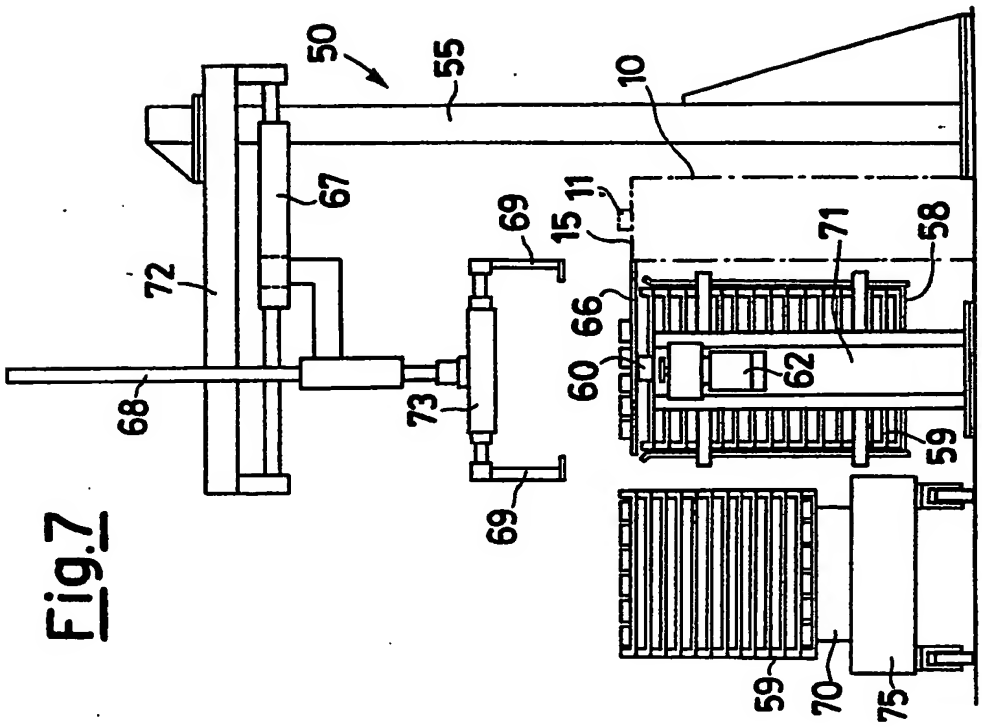


Fig.7

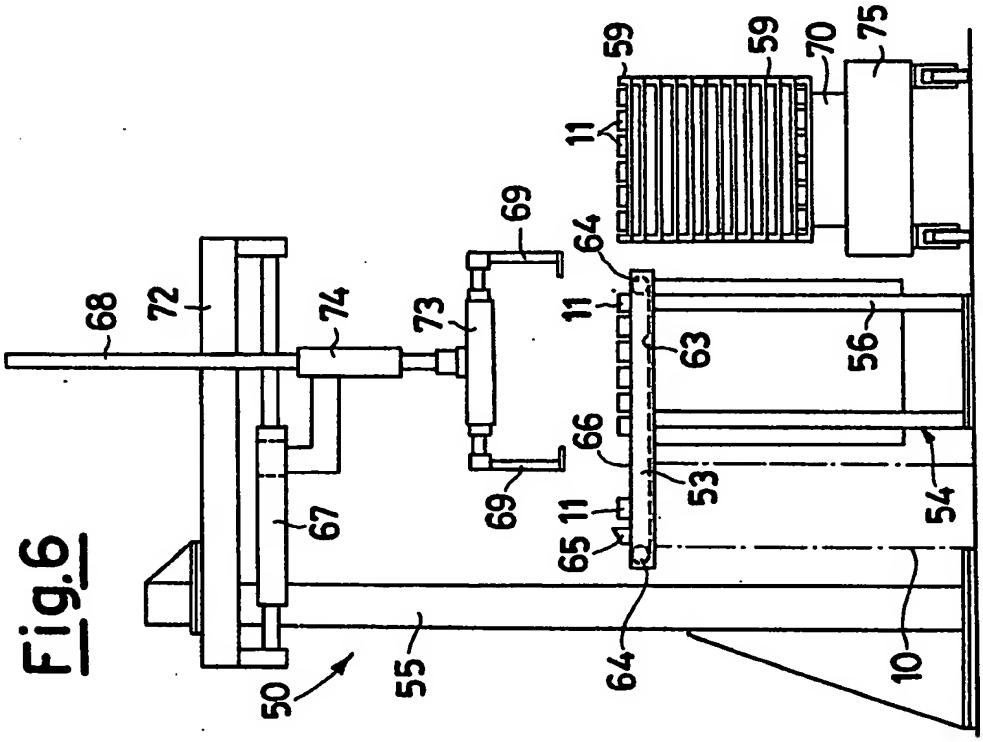


Fig.6

SPECIFICATION

Automatic equipment for the selection and the adjustment of sectluon bars in machines producing extruded plastic sections

The present invention relates to an automatic equipment for the selection and the adjustment of section bars of thermoplastic material on machines for the production of extruded plastic sections.

It is known that a line for the continuous production of extruded thermoplastic sections, is essentially composed by: a variable-speed extruder, a cooler-former unit, which determines the outer size of the section, a variable-speed pulling unit, which pulls the section at the proper speed, a shearing unit for cutting the bars into a predetermined length, and finally a unit for receiving and unloading the section lengths after that they have been cut.

The estruded sections of plastic material so obtained can show dimensional deformations relatively to the desired designed shape, as for the true profile as well as for the thicknesses of the walls of the section.

In fact, the outer profile of the extruded sections of thermoplastic material is obtained by extruding the material through a die, cooling it and calibrating it on its outer surface by means of tools having shapes equal to and complementary to those of the designed shape which one wants to obtain.

As regards the thicknesses of the walls it must be remarked that, by the thermoplastic material being, during the extrusion step, soft and/or plastic, it can be stretched or elongated to a greater or lesser extent by the pulling unit.

Thus greater or lesser thicknesses of the section and hence volumes and weights per measurement unit can be obtained as a function of the pulling speed set by the operator, which consequently determine considerable variations of the profile's own weight.

It results thus evident that the operator, in order to obtain the uniformity of the section shape, must continuously check the thicknesses or the weight of the section, and carry out manually and with uncertain approximation the adjustment of the pulling speed, more or less satisfactory results being obtained, above all deriving from his skill and fastness in corrective action.

It is known that, in order to be able to form, smooth and uniformly cool the section, the cooler-former-calibrator unit must receive the same section in the dimensions—as for volume and weight—as designed.

It is furthermore known that the extruder and the related equipment may, due to various reasons, such as variability in granulometry, lack of homogeneousness of the material, the feed, the humidity, and so forth, not supply a precise and continuous unitary amount of extruded product, obliging the operator to perform a continuous control action, with consequent related adjustments of the speed of pulling unit.

From all the above, it results that on a normal extrusion line, as hereinabove described, inasmuch as automatic checks of the weight, which is the main cause of the retaining of the shape of bars, are not provided, a rather skilful operator, who carries out the checks and the necessary adjustment and setting-up actions, must be always attending the production line.

A primary purpose of the present invention is to eliminate the described need of carrying out continuous manual checks of the thicknesses and/or of the weight of the extruded sections, rendering the said operation and the consequent adjustment automatic and more reliable.

A further purpose is to be able to automatically select the extruded bars of thermoplastic profile which are up to the required requisites, from those faulty as for shape or profile, due to insufficient precision in thickness and weight.

These and further purposes according to the present invention are achieved by providing an automatic equipment for the selection and the adjustment of section bars in machines for the production of extruded plastic sections of the type installed downstream an extruder unit, a pulling unit and a unit for cutting into bars the continuous extruded section, characterized in that it comprises a base bearing atop a table on which the said section is supported and slides, means for the vertical displacement of said support table between a position aligned to said extruder unit and a position lowered in correspondence of means for weighing said cut bar, solid with said base, means for the lateral unloading towards two opposite sides of said cut bars, suitable to be selectively controlled by said weighing means in their lowered position, and an electronic unit to carry out the comparison of the value detected by said weighing means to a predetermined value, so to cause the unloading of said bars on one side or on the other side, and to correct the adjustment of the plastic sections producing machine.

The structural and functional characteristics and the advantages of an equipment according to the present invention shall be better understandable from the following exemplifying and not limitative disclosure, referred to the related schematic drawings, wherein:

Fig. 1 is an elevation view of an equipment according to the invention, towards which a continuous bar is fed;

Fig. 2 is an elevation view equivalent to that of Fig. 1 in a different operating step;

Fig. 3 is a sectional view according to path III-III of Fig. 2;

Fig. 4 is a sectional view according to path

IV-IV of Fig. 2;

Fig. 5 is a side elevation view of an alternative unloading means;

Fig. 6 is a side view according to arrow VI of Fig. 5; and

Fig. 7 is a side view according to arrow VII of Fig. 5.

Referring to the drawings, an automatic device 10 for the selection and the adjustment of section bars 11 is provided in machines producing sections of plastic material downstream an extruder with related pulling unit, schematically shown in 12, and a shearing machine 13 which converts the continuous bar into lengths of predetermined size.

The automatic equipment 10 comprises a base 14 relatively to which vertically movable results a support table 15, operatively supported on a crosspiece 16 through pairs of cylinders 17, 17a, positioned transversely to said table, said crosspiece 16 being vertically guided relatively to side end shoulders 18 by means of guide columns 19 sliding inside related bores 20 provided in the same crosspiece.

The vertical shift of the crosspiece 16 is controlled by a couple of cylinders 21 or vertical shift means, e.g., pneumatic means, constrained to the same crosspiece 22 and articulated relatively to the base 14 in 23.

The two pairs of cylinders 17, 17a, acting as side unloading means, result hinged in 24 to the crosspiece 16 and rotatably support, at the end of their stems 25, through hinges 26, the support table 15, furthermore provided being "V"-shaped support cradles 27 solid with said crosspiece 16, suitable to guide the hinges 26 during the relative rotation of one of the longitudinal edges of the support table 15 during the step of lateral unloading by tilting, to the purpose of realizing the selection of the section bars 11.

It must be observed that underneath said support table 15 a cylinder 29 results constrained onto a related support bracket 28, having the shape of an upside-down omega, said cylinder 29 bearing at the end of its stem 30 a beam 31 supporting a pair of guide rollers 32 for the lateral guiding of the extruded plastic section, so to provide a mobile guide unit generally indicated with 38 in Figs. 1 and 2.

A pair of holes 33, provided in the support table 15, allows said guide rollers 32 to vertically move between an upper operating position, and a lower position under the same table 15 during the lateral unloading step, provided being guide stud bolts 34, constrained in 35 to the support bracket 28 and sliding inside related bushings 37 and holes 36 prearranged and provided in the bar 31.

The support table 15 is moreover provided in a central position thereof in correspondence of which the section bar 11 positions itself, with a set of three openings 39 which allow the passage of weighing trays 40, in the completely lowered position of the crosspiece 16.

The weighing trays 40 are arranged on vertical columns 41 extending from the base 14, with which they are solid, said trays 40 being supported on load cells 42, intermediate between arms 43 solid with the columns 41 and arms 44 bearing the same tray 40, so to provide individual weighing means or units, generally indicated with 45.

The three load cells 42 result connected through related lines 46 to an electronic unit, schematically shown in 47, which determines the end weighing value of the section bar 11 under test, compares it to the neighbourhood of the preset and tolerated value and consequently selects the section bars.

The electronic unit 47, besides comparing the value detected by said weighing means 45 to a preset value, acts through a control line 49 connected to the sections manufacturing machine or to units thereof 12 to the purpose of correcting the adjustment, so to bring back to a correct value the section bars being manufactured.

The operating sequences are the following: The continuously extruded thermoplastic section runs in the direction as indicated by arrow 48.

When it has reached its preset length, it is cut by the specially provided shearing unit 13. At this point, the support table 15, connected to the crosspiece 16, is lowered as shown in Fig. 2 by means of the cylinders 21, up to a completely lowered limit position. The residual portion of the section being extruded continues its production run in the direction of arrow 48.

The cut section bar 11 comes thus to lay on the trays 40 of the weighing units 45 which weigh heavy on the load cells 42 as shown in Fig. 2, said trays 40 passing inside the openings 39 provided in the support table 15.

The load cells 42 generate a signal proportional to the load they are submitted to, and transmit this signal through the lines 46 to the electronic unit 47, which adds up the loads the three cells 42 are submitted to, and displays the weight of the section bar 11.

As a consequence, should the weight result within the preset tolerances, the support table 15 is lifted on one longitudinal edge only by the action of the pairs of pneumatic cylinders 17, operating under thrust conditions, and visible in chain in Fig. 3, whilst the other longitudinal edge of the support table 15 is retained in its lowered position by the pneumatic cylinders 17a, operating under pull conditions, by means of the pin 26, each one of said pin being resting on its support cradle 27.

Should the weight result outside the preset tolerances, the support table 15 is lifted in correspondence of its opposite longitudinal edge by the cylinders 17a operating under

thrust conditions, whilst the other edge of the support table 15 is kept in its lower position by the cylinders 17 operating under pull conditions.

It can be thus observed that the section bar 11 can be unloaded by tilting from the side prearranged for the collection of the bars within the specification tolerances, or from the opposite side, prearranged for the bars outside the specification tolerances.

But it must be noted that the section bar 11 cannot slide downwards both on the one and on the other side if it is retained by the rollers 32 borne by the guide units 38 as shown in continuous line in Fig. 4.

Thus, when the support table 15 has come to its maximum tilt, the guide rollers 32 are caused to retract by the pneumatic cylinder 29 positioned under the same table 15 and the section bar can thus be unloaded downwards.

Furthermore, if the error in weight results out of tolerance, the electronic unit, besides signalling the error acoustically and/or visually by digital display, or another type of display, of the resulting weight, carries out the correction and the adjustment, via a control line 49, of the speed of the pull unit, or of the extruder 12, or of the metering unit (not shown), to the extent necessary for the weight to re-enter back into the weight tolerances.

If the weight does not re-enter back into the tolerances, after a number of weighed bars 11, as prearranged by the operator, the equipment carries out automatically the actions necessary for shutting down the whole plant.

Preferably, the lateral unloading means of bars 11 by tilting, as illustrated above, are so arranged as to act in correspondence of the side provided for collecting the bars out of the specification tolerances.

If on the contrary having bars manufactured, cut and arranged in an ordered fashion, without streaks on their outer surfaces, and so as not to undergo deformations, is necessary, an alternative lateral unloading means as shown in Figs. 5, 6 and 7, and disclosed hereunder, can be used. Laterally to the automatic equipment 10, the overall dimensions of which are schematically displayed by chain, a further unloading or lateral shift means, generally indicated with 50, is provided, suitable to act on the bars 11, which come to lay on the support table 15 of extruder 12.

The lateral unloading means 50 comprises respectively a set of three lateral shift units 54, positioned transversely to the support table 15, formed by columns 56 bearing on one side a stationary table formed by shelves 57. On the opposite side provided is an arm or guide 53, protruding in a cantilevered position, and which enters also the equipment 10, inside which a chain 63 is guided to slide, driven by motor-driven sprocket wheels 64, furthermore provided being a pusher element 65 solid with said chain 63 and it too being sliding, acting on the individual bars 11, so to move them from the support table 15 towards a table 66 provided above the column 56.

Moreover, to each of the three lateral shift units 54 associated results a loader device 52, bearing a stack of individual tables 59, acting as "U"-shaped receiving means, suitable to receive inside their interior a plurality of bars 11, and such to be suitable to be superimposed to each other so to act as spacers, so to safeguard the section bars contained inside them against any possible deformations due to their weight.

A stack of tables 59 is placed on a slide 58 vertically moved by a screw 61 acting on a related nut screw (not shown), solid with the same slide 58, said screw 61 being rotatably supported on a frame 71 and operatively connected through a transmission 51 to a ratiomotor 62.

On the upper portion of said frame 71 provided is a loader element 60, which acts in such a way as to remove the last table 59 placed atop the stack, pushing it into its operating position on the stationary table 57, when the preceding table has been drawn and the ratiomotor 62 has so operated, as to cause the stack to lift by one step, equal to one single table 59.

A frame 55, having e.g. the configuration of a portal, and positioned sideways parallelly to the bars 11 collected above the table 66 supports a grip and conveyance unit for gripping and conveying said individual tables 59.

A pair of crosspieces 72, constrained to the frame 55 at an end thereof, supports actuator elements 67 generating a horizontal shift for at least a pair of gripping-arms pincers 69, said pincers too being equipped with an actuator 73 for the opening—by mutual spacing apart—or the closure—by mutual approach—of arms 69.

Moreover, provided are further actuator means 74 which secure the vertical sliding on guides 68 of pincers 69, so to keep these latter to a raised position, or to a lowered position relatively to the support and unloading tables.

The individual tables 59 fully loaded with bars 11 are then stored and stacked above each other on the flatbed 70 of an evacuation car 75.

The lateral unloading and conveyance means 50 operates as follows. When the selector unit has detected the right weight tolerance of the section bar 11, the pushing element 65 moves up to a preset stroke limit (not shown) the cut section 11 on the tables 66 of columns 56, soon afterwards returning back to its initial position. This is possible, because on the automatic equipment 10 special recessed seats have been provided. Then, the pushing element 65 conveys the lengths of cut section

11, as they are manufactured, approaching them to one another, either in mutual contact, or spaced apart from each other by means of the stop or limit contact it is provided with, up to complete the preset amount of section bars. In a prior step, the loader element 60 had placed a table 59 on the stationary table 57.

At this point, the grip and conveyance unit formed by the horizontal actuators 67 and 73, and by the vertical actuators 74, actuates the gripping arms 69.

These actuator devices are either pneumatically or hydraulically or mechanically driven by actuator equipment known and herein not described. When the preset amount of sections 11 on the tables 66 is complete, the gripping arms run downwards along the guides 68, are retracted towards the centre, grip the table 59 laid on table 57 from underneath, lift it so to receive all the sections and convey it upwards.

The horizontal actuators 67 move laterally and convey the table 59 fully loaded with section bars 11 so to place it on the flatbed of the car 75.

The arms 69 are they too provided with contacts, herein not shown, which oblige the same arms to open outwards as they come in contact with the flatbed 70 or with the already stored and underlying tables 59.

The tables 59 can be simply flat, but they are in particular prearranged, as already said, in a wide-"U" shape, with two ledges at their ends, to the purpose of containing the sections, without the same being burdened by the weight of the subsequent layers, so preventing any possibilities of deformations thereof.

At load of car 75 complete, the same must be sent to the strapping or to the packing of the bundle of sections, and must be replaced by another one.

Both the loader device 52 and the lateral shift unit 54, as well as the pincers 69, shown in a number of three elements in the example, must be at least two for the unloading means 50 to be able to operate.

CLAIMS

1. Automatic equipment for the selection and the adjustment of section bars in machines for the production of extruded plastic sections, of the type installed downstream an extruder unit, a pulling unit and a a unit for cutting into bars the continuous extruded section, characterized in that it comprises a base bearing atop a table on which the said section is supported and slides, means for the vertical displacement of said support table between a position aligned to said extruder unit and a position lowered in correspondence of means for weighing said cut bar, solid with said base, means for the lateral unloading of the said cut bars towards two opposite sides, suitable to be selectively controlled by said weighing means in their lowered position, and an electronic unit having the function of carrying out the comparison of the value detected by said weighing means to a predetermined value, so to cause the unloading of said bars to take place from one side or from the other side, and of correcting the adjustment of the plastic sections producing machine.

2. Automatic equipment according to claim 1, characterized in that said lateral unloading means are installed on board of a crosspiece, constrained to said means for vertical displacement, and support said support table.

3. Automatic equipment according to claim 1, characterized in that said support table has openings provided centrally in the direction of said section bar being fed and under test, through said opening passing said weighing means in their lowered position.

4. Automatic equipment according to claim 1, characterized in that the said weighing means comprise support trays for supporting said bar under test, said trays being positioned on load cells operatively reacting with reference to said base.

5. Automatic equipment according to claim 1, characterized in that solidly with said support table provided are lateral guide means for sideways guiding said section bar, said lateral guide means being movable between an operating position above said support table, and an unloading position for unloading said bar, underneath said support table.

6. Automatic equipment according to claim 1, characterized in that said means for the vertical displacement of said table are cylinders.

7. Automatic equipment according to claim 2, characterized in that said means for the sideways unloading of said section bar are tilting means.

8. Automatic equipment according to claim 7, characterized in that said tilting means are pairs of cylinders, positioned crosswise relatively to said support table, operatively hinged on one of their sides to said crosspiece, and on the other side thereof to said support table, said cylinders being actuated in correspondence of a side of said equipment, or in correspondence of the other side of said equipment, according to the detected value.

9. Automatic equipment according to claim 1, characterized in that furthermore provided is an electronic unit which detects the weighing values for each individual bar, and shuts down the units of the sections producing machine after a certain number of wrong weighing values.

10. Automatic equipment according to claim 1, characterized in that said means for the sideways unloading of said section bars are pusher elements, said pusher elements being positioned crossways relatively to said support table, sliding inside guides which move

the individual bars, after that they have been selected, onto a table parallel to the first table, spaced apart from each other, furthermore beneath said parallel table provided being receiving means for receiving said selected and spaced-apart bars.

11. Automatic equipment according to claim 10, characterized in that said receiving means are fed beneath said parallel table by a loader device, vertically movable stepwise, furthermore provided being a horizontal loader element for loading said receiving means on a stationary table solid with said transversal guide.

12. Automatic equipment according to claim 10, characterized in that said receiving means are tables having a wide-"U" shape provided with end ledges.

13. Automatic equipment according to claim 10, characterized in that furthermore provided are pincers-shaped grip means for gripping said receiving means fully loaded with bars, so to lift them, to move them sideways and to place them on an evacuation car.

14. Automatic equipment according to claim 11, characterized in that said loader device comprises a rotary support frame for a screw driven by a transmission by means of a ratiomotor, on said screw engaged being a nut screw solid with a slide bearing said empty receiving means stacked above each other.

15. Automatic equipment according to claim 13, characterized in that said grip means comprise a frame bearing on cantilevered crosspieces a pair of grippingarms pincers operatively driven so to open out and to approach each other by an actuator element, further actuator means being provided to the purpose of causing the horizontal and vertical movement relatively to said crosspieces.

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